Hot Plate Digestion Standard Laboratory Module (SLM™)

General Overview of the Hot Plate Digestion SLM

This SLM heats and acid-digests a sample, monitors the extraction process, and dilutes the sample to the desired final volume.

Environmental Protection Agency (EPA) Method

The Hot Plate Digestion SLM is an automated instrument designed to perform the following three USEPA Methods: 3010 (SW-846 Third Edition, September 1986) "Acid Digestion Of Aqueous Samples And Extracts For Total Metals For Analysis By FLAA Or ICP Spectroscopy," 3020 (SW-846 Third Edition, September 1986) "Acid Digestion Of Aqueous Samples And Extracts For Total Metals For Analysis By GFAA Spectroscopy," and 3050 (SW-846 Third Edition, September 1986) "Acid Digestion Of Sediments, Sludges, And Soils."

Standard Analysis Method (SAM)

The Hot Plate SLM supports any SAM system requiring the acid digestion of solid samples such as the metals SAM.

Advantages

The Hot Plate Digestion SLM performs three USEPA methods without the assistance or intervention of an analyst, thus reducing the labor cost per sample by a significant amount. Samples are taken from the initial sample matrix to an extract diluted to the desired volume and ready for testing, all in the one SLM. All operating parameters and information are logged through the task sequence controller (TSC) to the database as the process sequence takes place.

General Description of the Hot Plate Digestion SLM

The SLM is the integration of a commercial instrument, the Zymark™ BenchMate™ system, and a digestion module specifically developed by the Contaminant Analysis Automation Program. The digestion component receives bar-coded beakers

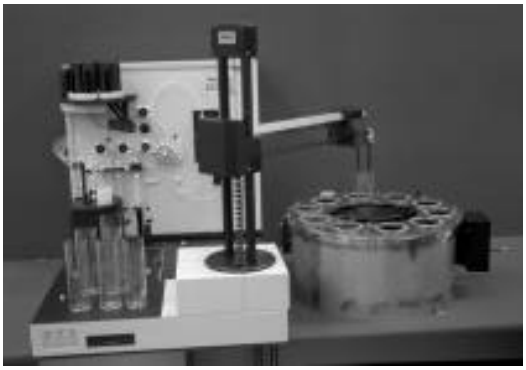

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Figure 1. The Hot Plate Digestion SLM.

loaded with the sample and digestion acid. Once loaded, the module heats and digests the sample; monitors liquid levels, gas evolution (during a hydrogen peroxide reaction), and color changes; and finally concentrates the treated sample to a given volume. The BenchMate™ assists by loading the beakers, moving them for cooling, removing them for solvent addition, and performing the filtration and the final dilution to the desired volume.

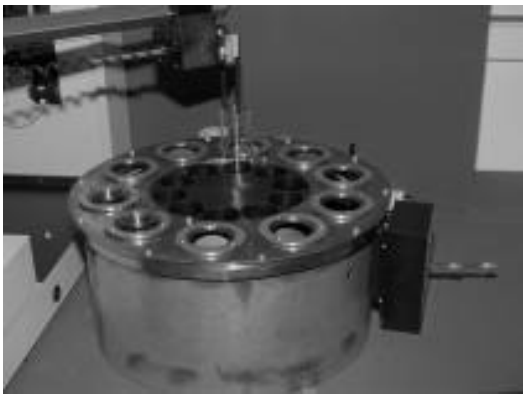

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Figure 2. Insertion of digestion vessel into hot plate.

The technical highlights are 1) the use of simple machine vision techniques to monitor the level and color and 2) the use of acoustic emission to monitor for gas evolution during the hydrogen peroxide reaction. The BenchMate™, which is the acid-resistant model, is slightly modified for use with the specific glassware in the system. Overall control is performed by an

on-board, embedded controller that interfaces to the TSC and the BenchMate™ controller. All system operations are logged into the external database for chain-of-custody records.

Status

This SLM is a working prototype. The unit has not been validated.

Industrial Partner

Zymark Corporation

Developers

The Department of Energy laboratory responsible for the Hot Plate Digestion SLM development is Pacific Northwest Laboratories.

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